ORIGINAL

TFT INC
3090 OAKMEAD VILLAGE DRIVE
SANTA CLARA, CA 95051

October 29, 1993

Ms. Danna R. Searcy
Secretary
Federal Communications Commission
1919 M Street N.W.
Washington, D.C. 20554

RE: MM Docket No 93-225
Comments of
TFT, Inc.

Dear Ms. Searcy:

Enclosed are an original and nine copies of TFT's Comments in the above- referenced proceeding.

Should there be any questions concerning the accompanying submission, please contact me.

Sincerely,

Joseph C. Wu
President

Enclosures (10)

(408) 727-7272 • FAX (408) 727-5942

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of

Amendment of Part 73 of the Commission's Rules to Clarify the Definition and Measurement of Aural Modulation Limits in the Broadcast Services	)))))	MM Docket No. 93-225

To: The Commission

TFT, INC.'S
COMMENTS

Introduction

In response to the Commission's Notice of Inquiry adopted on July 23, 1993, to explore the Commission's rules and policies that relate to the definition and measurement of aural modulation limits, TFT, Inc., a manufacturer of devices to measure modulation for AM, FM, and TV services has undertaken a series of tests on the effects of overmodulation and recommends that the former modulation standard for Automatic Transmission Systems Section 73-342 be reinstated as the standard for redefining peak modulation.

TFT concludes, from tests detailed in Appendix 1, that sufficient methods of measuring FM modulation already exist in the marketplace to prevent noticeable interference to the first adjacent channels and to insure no interference to the second adjacent channels in accordance with the definition of former Section 73-342.

TFT has focused its comments on FM modulation, but similar arguments may be made for TV and AM services in order to define overmodulation as a function of

(1) Peak amplitude
(2) Peak duration
and (3) Peak recurrence rate

Measurement of FM Modulation Test

By using the test arrangement described in Appendix 1, TFT measured the effects of an overmodulated test signal into the first and second adjacent channels of an FM carrier. The results show that a slightly noticeable signal is observed and heard in the first adjacent channel when overmodulation of the main channel occurs (See Appendix 1, Figures 1B, 1C and 1D). This interference is heard as a low level "clicking" noise when no modulation is present in the first adjacent channel. If modulation were present in the first adjacent channel, this "clicking" sound would be masked. The level of interference ranges from -63 db from 110% modulation level in a professional modulation monitor, such as the TFT Model 844A, to -22 db in a hand-held, consumer-grade receiver. No interference, however, is noticed at all in the second adjacent channel.

Description of TFT's Method of Measurement of FM Modulation

Since 1984, TFT has been manufacturing FM modulation monitors which use the method described in Appendix 2 to display and detect both average and peak modulation for the FM service. These monitors feature analog meters for average modulation display and peak indicators, described in Appendix 2, as a Peak Modulation Duration Differentiator. A TFT Model 844A with this design was used as one of the receivers in the test setup described in Appendix 1. This same circuitry is incorporated into current TFT models of AM, FM and TV modulation monitors.

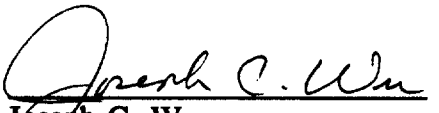
TFT's Modulation Monitor Calibration Method

Since 1973, TFT has been incorporating a frequency-synthesized type modulation calibration circuit into its FM and TV modulation monitors which is described in Appendix 3. This calibration circuit offers stations in the FM and TV service the capability of calibrating frequency deviation accuracy in monitors frequently and easily without the expense and skills required by other methods. Thus, by utilizing TFT's method, station operators can insure that their periodic observations of modulation peaks are accurate within 1%. Technology available today permits this method of calibration to be performed by a single, inexpensive IC. To use a Bessel null method of calibration would require an FM modulated RF signal generator, a detector with sufficient accuracy to observe a null of the FM carrier, an audio frequency generator with extremely accurate frequency calibration, and a skilled operator. Often broadcasters do not have access to the relatively expensive resources required by this Bessel null technique; the TFT calibration circuit, therefore, offers a ready, inexpensive and easy method to insure that modulation is accurately measured and that peak modulation is detected.

Conclusion

Based on tests conducted by TFT and by virtue of the existing installed equipment base of units capable of accurately measuring peak modulation amplitude, duration, and rate of recurrence with a counter display such as the TFT Model 844A, TFT recommends that the Commission adopt a definition of overmodulation by redefinition of the former Section 73.342(a) in order to minimize interference to first adjacent channels and to insure no interference to second adjacent channels.

Respectfully Submitted
TFT, Inc.
3090 Oakmead Village Drive
San Jose, California 95051



Joseph C. Wu
President

APPENDIX 1

TEST TO MEASURE PEAK MODULATION INTERFERENCE TO ADJACENT CHANNELS

TEST OBJECTIVE

To measure and detect the effect of degradation of audio performance in first and second adjacent channels due to modulation peaks consisting of 10 bursts of modulation per minute and with multiple peaks occurring within a single 5 millisecond interval and modulating the main FM carrier at 110% (±82.5 kHz).

TEST SET UP

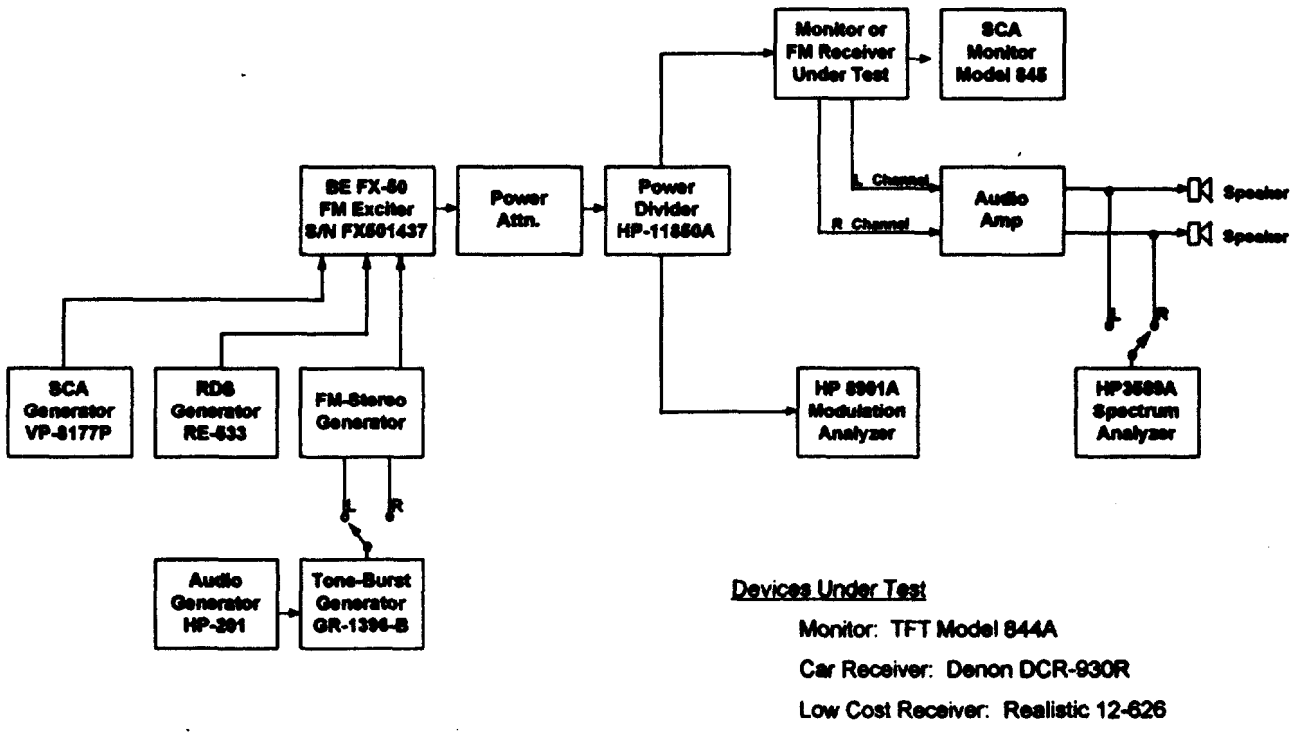


Figure 1A: PEAK MODULATION INTERFERENCE TEST SET UP

PROCEDURES

(1) Set tone burst frequency to 10 kHz, 5 milliseconds wide (50 cycles of 10 kHz audio signal) and 10 burst per minute.

(2) Vary the percentage of modulation of the FM exciter, measure level of interference with a spectrum analyzer and listen to the L and R demodulated channels of the monitor or FM receiver under test for interference when modulation peaks occur at 110% modulations. (± 82.5 kHz).

RESULTS

(1) There is no detectable interference in the second adjacent channels from the tests.

(2) There is a low level "clicking" noise in the first adjacent channel when no program modulation in the first adjacent channel.

(3) The measured level of interference in the first adjacent channel ranges from 22 db to 63 db below 100% modulation depending on the type of receiver under test (See Appendix 1, Fig. 1B, 1C and 1D):

RECEIVER	INTERFERENCE
Modulation Monitor	-63db
Automobile Receiver	-30db
Low-Cost Portable Receiver	-22db

Noise Spike on Adjacent Channel Audio:

Test Conditions: Main channel at 106.5 MHz modulated at 110% by a 5 millisecond time burst at 10 kHz, 10 bursts per minute, adjacent channel at 106.7 MHz.

Results:

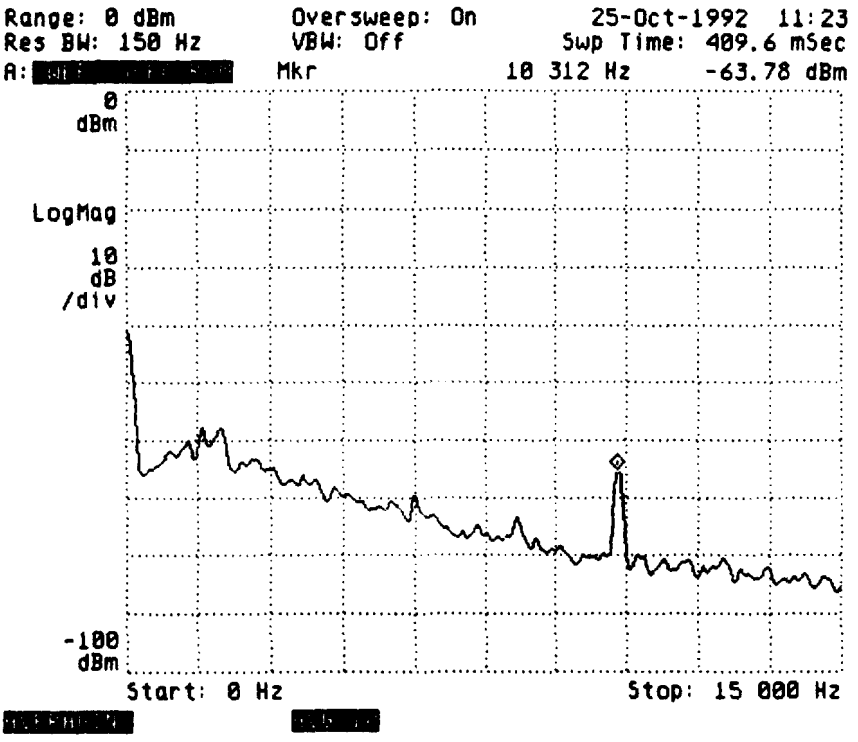


Figure 1B: Audio Output from TFT Model 844A Modulation Monitor.

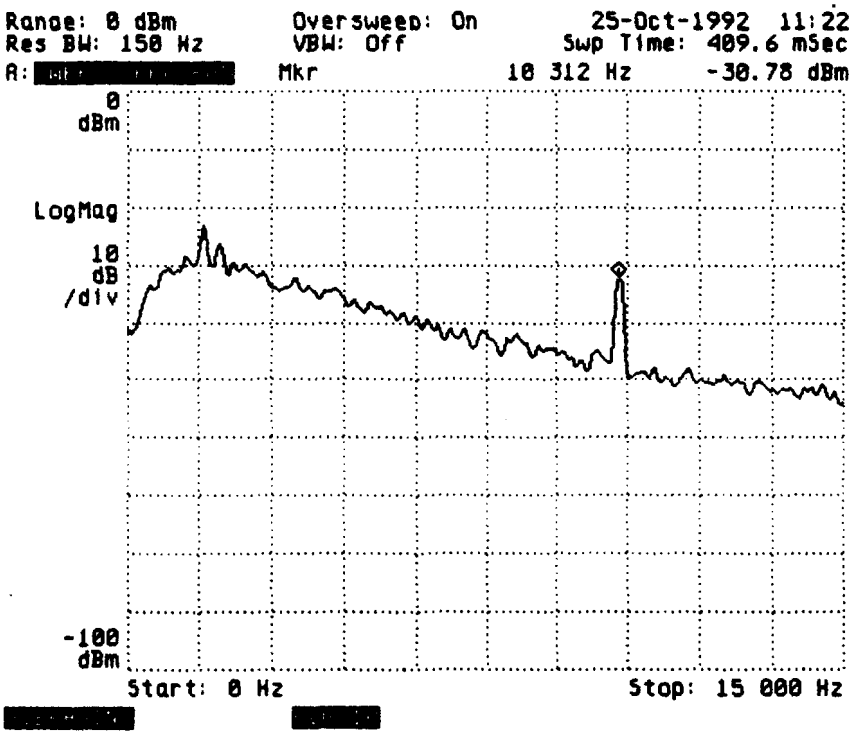


Figure 1C: Audio Output from a Automobile Receiver.

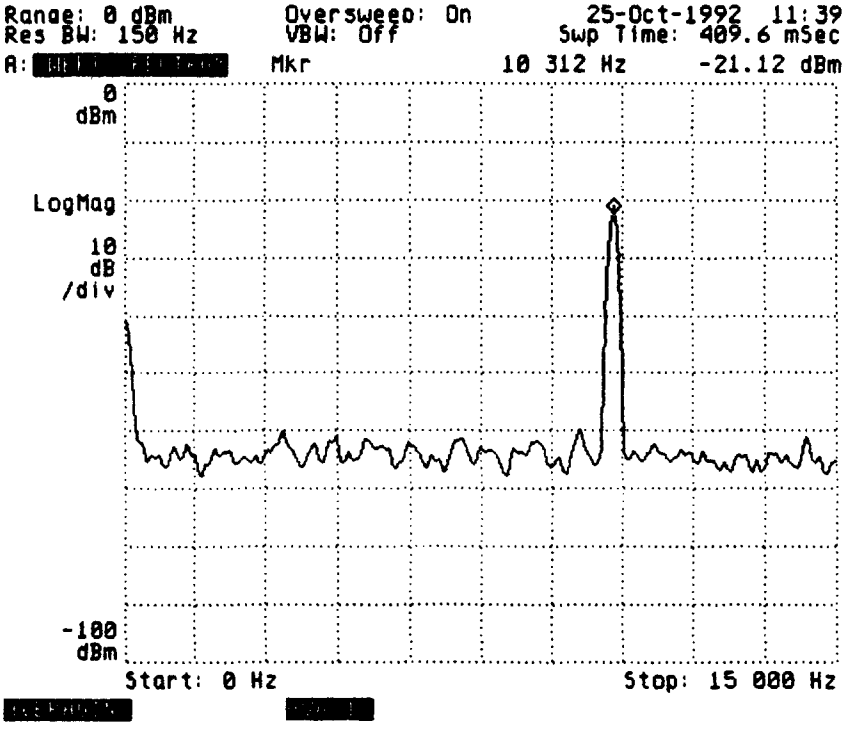


Figure 1D: Audio Output from a Low-Cost Portable Receiver.

APPENDIX 2

DESCRIPTION OF PEAK MODULATION DURATION DIFFERENTIATOR (PMDD)

DESCRIPTION

PMDD is an apparatus which detects modulation peaks exceeding a preset level and occurring within a single 5 millisecond interval, which accumulates a count of those peaks, and resets itself at one minute intervals.

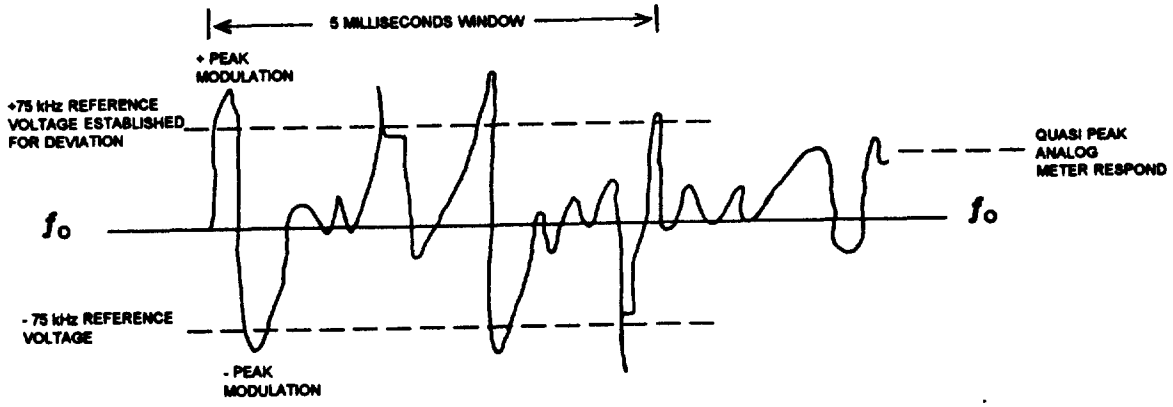


Figure 2A: Composite FM Baseband Signal Input to the Peak Modulation Duration Differenciator (P.M.D.D.)

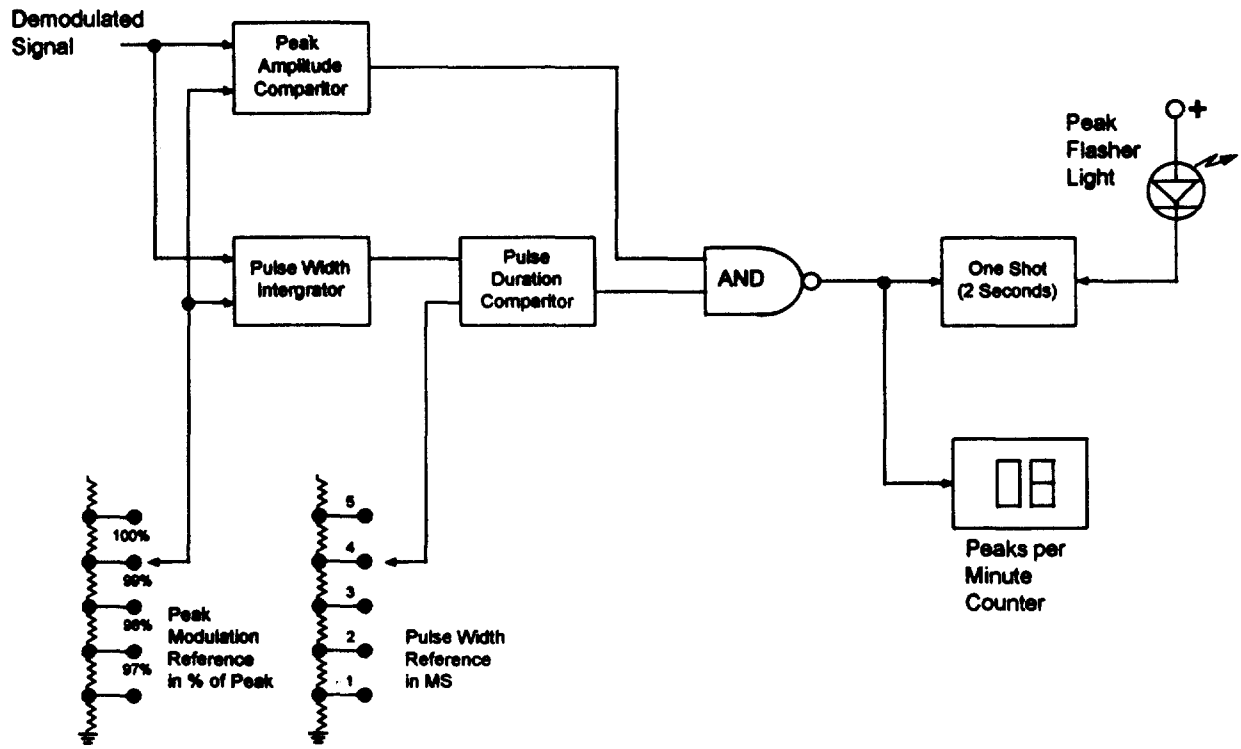


Figure 2B: PEAK MODULATION DURATION DIFFERENTIATOR CIRCUIT BLOCK DIAGRAM

APPENDIX 3

DESCRIPTION OF FREQUENCY SYNTHESIZED TYPE PEAK DEVIATION CALIBRATOR FOR FM MONITORS

DESCRIPTION

An apparatus to provide a reference signal, the peak to peak voltage of which represents ±75 kHz frequency deviation of a frequency modulated carrier as detected by an FM demodulator. The accuracy of this calibrator is better than 0.1%. This apparatus replaces a more expensive calibration method using a Bessel null technique.

THEORY OF OPERATION (See Figure 3)

Two crystal oscillators are set to oscillate ±75 kHz (within 0.1%) of the center frequency of an IF frequency (F_o) which feeds an FM discriminator in the calibration mode. The output of the two oscillators is gated by an audio signal approximately 400 Hz. The composite signal is then fed to the input of the IF amplifier; therefore, the peak to peak voltage from the output of the FM demodulator is directly proportional to the two input frequencies excursion, and the accuracy of the peak-to-peak voltage depends only upon the accuracy of the frequency of two crystal oscillators.

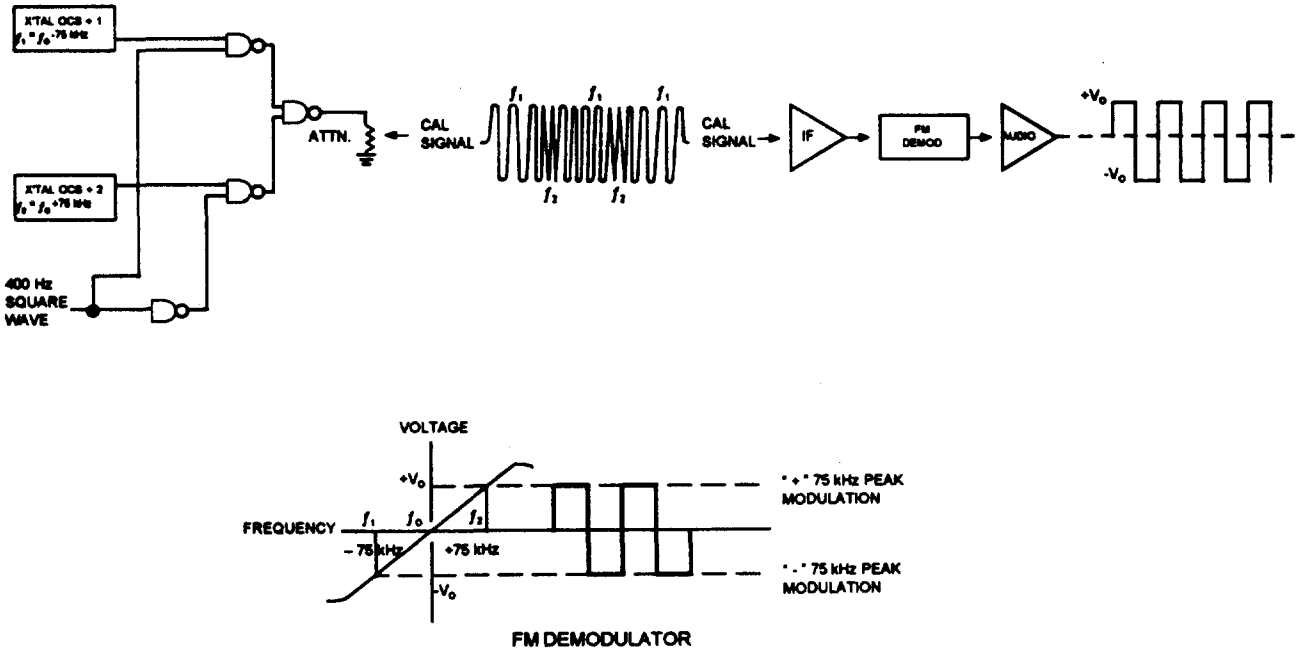


Figure 3: FREQUENCY SYNTHESIZED TYPE FM CALIBRATOR.